

The Decline of Teen Birth Rates: A Statistical Analysis

An Honors Thesis (HONR 499)

by

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Abstract

Teen pregnancy is a sensitive topic in today's society. While our culture has become more accepting of teenage pregnancy, even creating TV shows and movies based on the subject, it is still an area of concern for many people. One way to track teen pregnancy is to follow the trend of teen birth rates, which has been declining significantly in recent years. Several studies have attempted to pinpoint the exact cause of the decline. An analysis of the following eleven factors potentially contributing to teen birth rates gives a more broad sense of what may be happening in society: the number of rapes per 100,000 people; the number of abortions per 1000 women aged 15-19; the number of high school diplomas awarded per 1000 students; school expenditures per 100 students; the percentage of the population identifying as either Baptist, Mormon, Catholic, or Protestant; real per capita income per ten people; marriage rates; unemployment rates; and per-capita beer consumption rates. I analyze the following variables' statistical significance in a regression model in an attempt to understand what cultural factors may be contributing to the decline in teen birth rates.

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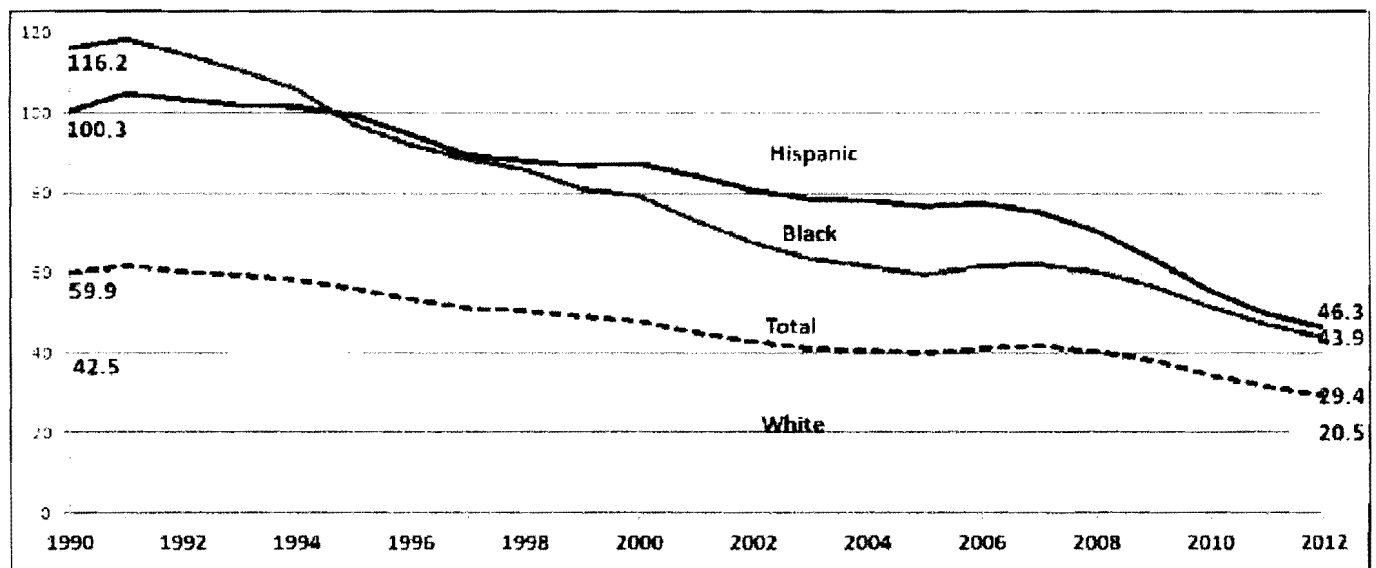
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1. Introduction

Over the last few decades, the United States has seen a significant decrease in the birth rate among teenagers. According to the US Department of Health and Human Services, the decline is nationwide and is not limited to teenagers of a certain race or ethnicity. The trend can be clearly seen in the figure below, obtained from the USDHHS website.

Figure 1: Birth rates per 1,000 females ages 15-19, by race/ethnicity, 1990-2012 (USHHS website)



It is unclear what has caused this change in teen birth rates, but there are several possibilities that could be considered. For example, the decision of *Roe v. Wade* legalized abortion in 1973 and made abortions more easily accessible for women as well as more acceptable within society. There has also been a cultural shift toward equality for women both in education and in the workplace, placing a heavy emphasis on the success of women in their career fields. These societal changes beg the question, what exactly has impacted the teenagers and young women in the United States in a way that has decreased the birth rates among them so drastically? Is it possible that this trend will continue?

In this paper I address the question of what may be impacting the decline in teen birth rates in the United States. I consider multiple causes of the change within data compiled from all 50 states plus the District of Columbia across the years 2000, 2005, and 2008. In my analysis of these causes, I find that per-capita beer consumption, the percent of individuals in each state identifying as Baptist, and the number of rapes per capita have the most statistically significant

impacts on the teen birth rate. As each of these variables increases, there is an increase in the teen birth rate.

The rest of this paper is outlined as follows: I first address previous studies that are similar to my own and that concentrate on the same subject of the change in teen birth rates within the last few decades. I then describe the variables I consider in my analysis as well as my data and data sources. I also explain the methodology I used to analyze the data. Finally, I describe the statistical results of my analysis, including significant observations about the coefficients of the variables and a summary of relationships among the variables tested.

2. Background Information

I am not the first to investigate what may be causing the decline in teen birth rates over the years. Several studies in the last decade have focused on this topic, mainly in the areas of public health and economic status.

A study conducted in 2002 attempted to define a relationship between income inequality, poverty, and the teen birth rate. The study found that teen birth rates are affected by both poverty and income inequality (Gold, et. al. 77).

In 2003 a study was conducted to test what kind of effect beer taxes have on teen pregnancy. The study was conducted using data from the 1980s and 1990s; it was concluded that higher beer taxes have statistically significant negative effects on teen abortion rates, but have statistically insignificant effects on the teen birth rate (Sen 328).

In 2004, John Santelli headed a study done to explore whether or not improved contraceptive use can be used to explain the decline in teen birth rates. It was concluded in this study that delayed initiation of sexual intercourse as well as improved contraceptive use both contributed to the decline in teen pregnancy rates during the 1990s, which implies a contribution to the decline in teen birth rates during the same time period (Santelli, et. al. 80).

A similar study was conducted more recently in 2007, again by John Santelli and others, which posed the same question as the study in 2004. The 2007 study found results in agreement with the study done in 2004, suggesting that improved contraceptive use has contributed to the decline in teen pregnancy rates. The study even went so far as to conclude that improved contraceptive use has been the primary determinant of the declining rates (Santelli, et. al. 150).

While these analyses have each answered their own specific question of what single thing may be having an impact on teen birth rates, my analysis is broader in nature and considers multiple variables that could be impacting the decline in teen birth rates.

3. Data & Method

Variables. In this study, I have analyzed the impact of 11 different variables on teen birth rate in a linear regression model. I collected data from all 50 states and the District of Columbia for the years 2000, 2005, and 2008. The following variables were considered: the number of rapes per 100,000 people; the number of abortions per 1000 women aged 15-19; the number of high school diplomas awarded per 1000 students; school expenditures per 100 students; the percentage of the population identifying as either Baptist, Mormon, Catholic, or Protestant; real per capita income per ten people; marriage rates; unemployment rates; and per-capita beer consumption rates.

Data Sources. The data used in this study was compiled from the following sources:

- Number of rapes – Uniform Crime Reporting Statistics-UCR Data Online
- Number of high school diplomas – National Center for Education Statistics
- School expenditures – National Center for Education Statistics
- Religious affiliations – Pew Research Center
- Per Capita Income – U.S. Department of Commerce, Bureau of Economic Analysis
- Marriage rates – CDC/CNHS, National Vital Statistics System
- Unemployment rates – Bureau of Labor Statistics
- Beer consumption rates – Behavioral Risk Factor Surveillance System

Descriptive Statistics. Table 1 shows the descriptive statistics for each of the variables across all years the data was collected, obtained using Minitab. For the most part, there are no red flags in the data that would be a cause for concern in this analysis. The main issue worth noting is that the mean for the variables abortions, diplomas, Mormon, Baptist, and marriage rate do not fall near the middle of the ranges for each variable. This could indicate that the data values for these variables vary significantly and could cause problems when analyzing the data.

Table 1: Descriptive Statistics for Rapes, Abortions, Diplomas, School expenditures, Mormon, Baptist, Catholic, Protestant, Real PCI, Marriage rate, Unemployment rate, Teen Birth rate, and Beer consumption rate

<u>Variable</u>	<u>Mean</u>	<u>SE Mean</u>	<u>StDev</u>	<u>Minimum</u>	<u>Maximum</u>	<u>Range</u>
Rapes per 100k	33.857	0.926	11.299	12.922	81.115	68.193
Abortions every 1000	17.289	0.767	9.361	5	52	47
Diplomas/1000	55.17	5.1	62.25	2.81	372.31	369.5
School \$/100	91.8	2.19	26.69	46.74	196.98	150.24
Mormon	2.986	0.787	9.608	0.107	66.198	66.091
Baptist	6.573	0.759	9.264	0.107	32.166	32.059
Catholic	20.062	0.994	12.138	3.212	51.631	48.418
Protestant	17.83	0.721	8.796	2.798	43.97	41.172
Real PCI/10	41.383	0.561	6.85	29.16	76.482	47.322
Marriage rate	8.791	0.625	7.628	4	72.2	68.2
Unemployment rate	4.68	0.101	1.236	2.3	8.3	6
Teen Birth rate	42.21	1.02	12.46	17.9	70.1	52.2
Beer Cons	22.826	0.31	3.784	12.109	32.384	20.275

Regression formula: I used the aforementioned variables to obtain a linear regression model of the following form:

$$\text{Teen Birth rate} = \beta_0 + \beta_1 \text{Rapes per 100k} + \beta_2 \text{Abortions every 1000} + \beta_3 \text{Diplomas/1000} + \beta_4 \text{School \$}/100 + \beta_5 \text{Mormon} + \beta_6 \text{Baptist} + \beta_7 \text{Catholic} + \beta_8 \text{Protestant} + \beta_9 \text{Real PCI}/10 + \beta_{10} \text{Marriage rate} + \beta_{11} \text{Unemployment rate} + \beta_{12} \text{Beer Cons} + \epsilon$$

4. Results

Regression output. Table 2 summarizes the Minitab regression output for the linear regression model relating the 11 variables to teen birth rate.

Table 2: Minitab Regression Output for Teen Birth Rate vs. Rapes, Abortions, Diplomas, School expenditures, Mormon, Baptist, Catholic, Protestant, Real Per Capita Income, Marriage Rate, Unemployment Rate, and Beer Consumption Rate

<u>Term</u>	<u>Coef</u>	<u>SE Coef</u>	<u>T</u>	<u>P</u>
Constant	25.6899	8.40560	3.05628	0.003
Rapes per 100k	0.2065	0.06066	3.40380	0.001
Abortions every 1000	0.3723	0.09417	3.95370	0.000
Diplomas/1000	0.0191	0.01162	1.64783	0.102
School \$/100	-0.0820	0.04231	-1.93770	0.055
Mormon	0.0783	0.09033	0.86636	0.388
Baptist	0.7746	0.08945	8.65961	0.000
Catholic	-0.1149	0.07472	-1.53790	0.126
Protestant	-0.0019	0.09500	-0.02030	0.984
Real PCI/10	-0.2485	0.16449	-1.51070	0.133
Marriage rate	0.0810	0.09433	0.85857	0.392
Unemployment rate	0.6596	0.62937	1.04804	0.296
Beer Cons	0.5724	0.20887	2.74039	0.007

Statistical Significance. Setting $\alpha = 0.05$, a t-test of each coefficient reveals that the only statistically significant variables to the model are rapes per 100k, abortions per 1000, Baptist, and beer consumption with p-values equal to 0.001, 0.000, 0.000, and 0.007 respectively. These findings suggest that these particular variables could be impacting teen birth rates, while the other variables most likely do not have any effect on teen birth rates due to their statistical insignificance.

Observations. Simply looking at the values of the coefficients for each variable tells us much about their relationships to teen birth rates according to this particular model. A few coefficients that stand out are those of abortions, Baptist, unemployment and beer consumption. According to this model, for every 1% increase in beer consumption, the teen birth rate increases by 0.5724; for every 1% increase in the unemployment rate, there is an increase of 0.6596 in the teen birth rate; for every 1% increase in those who identify as Baptists, the teen birth rate increases by 0.7746; and finally, for each additional abortion performed on a woman aged 15-19, the teen birth rate increases by 0.3723. Each of these variables affects the teen birth rate significantly and, with the exception of the unemployment rate, is significant to the model overall. Taken at face value, these findings suggest that the

variables abortions, Baptist and beer consumption do in fact have an impact on teen birth rates.

Variable relationships. When considering these 11 variables, it is important to realize that the variables may not be completely independent from each other. For example, the unemployment rate could have an effect on real PCI or it is possible that the two variables are influenced by other factors not considered in this model. The unemployment rate may also influence beer consumption, although that could be a stereotypical assumption to make. There is most likely a direct relationship between the amount of school expenditures and the number of high school diplomas awarded to students each year. These relationships between the variables considered may have affected their statistical significance in the model.

One variable in particular to look at in regards to relationships is that of abortions per 1000 women aged 15-19. According to this model, the variable is significant with a p-value close to 0, but it is also positively related to teen birth rates – that is, an increase in abortions causes an increase in teen birth rates. This relationship does not make logical sense as an abortion terminates a pregnancy and most often does not result in a birth. This begs the question, how would an abortion cause an increase in the teen birth rate? The most logical answer is that of an omitted-variable bias. Since this model does not take into consideration all possible factors contributing to teen birth rates, it is likely that the abortion variable is over compensating for a variable which is not measured in this model. Therefore, the coefficient related to abortions is not accurately reflecting the impact abortions has on the teen birth rate, but is most likely a reflection of a combination of one or more other causal factors not tested.

I believe it is reasonable to conclude that of the 11 variables considered in this model, the number of rapes per 100,000 people, the percentage of the population identifying as Baptist, and the beer consumption rate all play a significant role in determining the teen birth rate. Since these variables are all positively related to the teen birth rate and the teen birth rate has been declining in recent years, it makes sense that these particular variables must be on the decline as well. The remaining variables do not appear to have a statistically significant impact on teen birth rates. Although abortions appear to be significantly related to the teen birth rate also, the nature of the relationship is questionable and therefore unreliable. Further investigation is necessary to determine other underlying causal variables that may be affecting the teen birth rate.

5. Conclusion

In this paper I summarized my analysis of 11 different variables I believed to be related to teen birth rates in the US. I gathered data from a variety of sources from all 50 states and the District of Columbia during the years 2000, 2005, and 2008 and created a linear regression model using these data points in an attempt to discover what may be causing the decreasing trend in teen birth rates that have been observed over the last few decades.

I found in my observation of the coefficients for each variable that the majority do not have a statistically significant impact on teen birth rates at all. Only a handful of the variables are significant: rapes, abortions, the Baptist religion, and beer consumption. Of these significant variables only three make logical sense – abortions must be disregarded due to a possible omitted-variable bias. However, I am confident in my conclusion that the number of rapes, the percentage of the population that is Baptist, and beer consumption rates do significantly impact teen birth rates. It is likely that changes in these variables have been contributing to the overall decline in teen birth rates in the past several years.

The list of variables considered in this analysis is by no means exhaustive. As demonstrated when considering the impact abortions has on the teen birth rate, there are most likely several other contributing factors to the decline in teen birth rates. While this study does contribute to the ongoing speculation of the subject, there is further research to be done in regards to the teen birth rate.

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